

Eurostar durum wheat

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Key words: *Triticum turgidum* L. subsp. *durum* (Desf.) Husn., durum wheat, cultivar description, yield, protein, disease resistance

Clarke, J. M., Knox, R. E., DePauw, R. M., Clarke, F. R., McCaig, T. N. Fernandez, M. R. et Singh, A. K. 2009. **Blé dur Eurostar**. Can. J. Plant Sci. **89**: 317–320. Eurostar est une variété de blé dur [*Triticum turgidum* L. sous-esp. *durum* (Desf.) Husn.] adaptée à la zone de production du blé dans les Prairies canadiennes. Elle se caractérise par un rendement grainier élevé et un grain à forte teneur en protéines, à très forte concentration de gluten et à faible teneur en cadmium. Eurostar a une paille aussi robuste que Strongfield, et est légèrement plus tardive et sa résistance aux maladies est semblable à celle des autres cultivars de blé dur homologués.

Mots clés: *Triticum turgidum* L. sous-esp. *durum* (Desf.) Husn., blé dur, description de cultivar, rendement, protéine, résistance à la maladie

Eurostar durum wheat was developed at the Semiarid Prairie Agricultural Research Centre, Agriculture and Agri-Food Canada, Swift Current, Saskatchewan. Filing for Plant Breeders Rights protection (08-6301) was accepted on 2008 Apr. 22, and Eurostar received registration No.6469 from the Canadian Food Inspection Agency on 2008 Jun. 17.

Pedigree and Breeding Method

Eurostar was selected from the cross G9575B-AA09C/DT498//DT691 made in 1999 and was developed using a modified pedigree technique. F₁ plants were grown in the greenhouse, from which seed was harvested and bulked. The F₂ generation was grown in a space-planted leaf (*Puccinia triticina* Eriks.) and stem rust (*P. graminis* Pers.:Pers.) epiphytotic field nursery near Swift Current in 2000 and selected for rust resistance, plant height, straw strength and maturity. Individual heads from selected plants were grown in F₃ rows near Lincoln, New Zealand, in 2000–2001 and selected for plant height, straw strength and maturity. The F₄ generation was grown in un-replicated yield trials near Swift Current and Regina, SK, in 2001 and evaluated for test weight, grain pigment and protein concentration, and five heads per selected line were sown in individual F₅ rows in a nursery near Irwell, New Zealand, and selected for plant height, straw strength and maturity. The F₆ generation

was grown in un-replicated yield trials near Swift Current and Regina, SK, and Lethbridge, AB, in 2002, selected for agronomic performance, disease resistance and quality (protein, pigment, gluten strength), and five heads per selected line were sown in individual F₇ rows in a nursery near Irwell, New Zealand. Un-replicated F₈ yield trials were grown near Swift Current (rainfed and irrigated), Regina and Lethbridge (irrigated) in 2003 and selected for agronomic performance, disease resistance and quality (protein, pigment, gluten strength).

An F₆-derived F₉ line designated A9930-QX2C was advanced to the Durum Central A Test (five locations) in 2004, where evaluation included Fusarium head blight (FHB) [*Fusarium graminearum* Schwabe, Group II [teleomorph *Gibberella zeae* (Schwein.) Petch}] assessment in a nursery near Portage la Prairie, MB, inoculated with *F. graminearum* infected corn seed, and loose smut [*Ustilago tritici* (Pers.) Rostr.], leaf and stem rust in nurseries near Glenlea, MB. Reactions to these diseases were further evaluated in the Durum Cooperative Test at nurseries near Glenlea and Carman, MB, along with common bunt [*Tilletia laevis* Kuhn in Rabenh., and *T. tritici* (Bjerk.) G. Wint. in Rabenh.], which was evaluated in a nursery near Lethbridge, AB. The stem rust races comprised a group of historical races representing a range of virulence genes (Fetch 2005) whereas the races of leaf rust used were

Table 1. Grain yield (least square means) of Eurostar and check cultivars in the Durum Cooperative Test, 2005 to 2007

	2005			2006			2007			2005–2007
	Zone 1 ^z	Zone 2	Mean	Zone 1	Zone 2	Mean	Zone 1	Zone 2	Mean	Mean
	(kg ha ⁻¹)									
AC Avonlea	4580	4690	4660	4200	4070	4130	3090	3290	3240	4010
AC Morse	3980	4410	4260	4570	4050	4270	3300	3480	3420	3990
AC Navigator	3800	4860	4470	4430	4410	4420	3150	3420	3340	4080
Strongfield	5070	5040	5050	4500	4390	4430	3420	3410	3410	4300
Commander	3590	4710	4300	4520	4570	4550	3370	3610	3540	4140
Eurostar	5310	4780	4970	4550	4260	4380	2700	3090	2990	4120
LSD _{0.05}	560	320	370	430	270	240	320	190	180	420
No. tests	4	7	11	5	7	12	3	8	11	34

^zZone 1 (Black Soils): Indian Head, Souris, Glenlea (2005 abandoned, 2007 not seeded), Brandon, Langdon (2007 excluded due to high coefficient of variation).

Zone 2 (Brown and Dark Brown Soils): Swift Current, Stewart Valley, Saskatoon, Regina, Lethbridge, Irricana (2005), Bieseker (2006 and 2007), Shouldice (2005), Vanguard (2007), Avonlea (2006 and 2007).

representative of recently occurring races (McCallum and Seto-Goh 2006). Races T26, T32 and T33 of loose smut and races L1, L16, T1, T6, T13, and T19 of common bunt were used for screening of the Durum Cooperative Test entries. The race designations are those described by Roelfs and Martens (1988) for stem rust, Long and Kolmer (1989) for leaf rust, Hoffmann and Metzger (1976) for common bunt, and Nielsen (1987) for loose smut. A9930-QX2C was tested from 2005 to 2007 in the four replicate Durum Cooperative Test as DT776. The 134 breeder lines originate from 144 plant rows in 2006, which in turn originate from F₆-derived F₁₀ plants grown in 2005.

Performance

Eurostar yielded, on average, similar to the strong gluten check Commander, 4% less than Strongfield, and 3% more than AC Avonlea and AC Morse in 3 yr of testing in the Durum Cooperative Test (Table 1). Time to maturity of Eurostar was 1 d later than AC Navigator,

2 d later than Commander, and 3 d later than the other checks in the Brown and Dark Brown Soil Zones (Table 2). Eurostar was 2 cm taller than AC Avonlea and 4 cm taller than Strongfield and had slightly weaker straw than both. Test weight of Eurostar was, on average for the 3 yr, significantly higher ($P < 0.05$) than all of the checks except Strongfield (Table 2). Average grain protein concentration of Eurostar was similar to AC Avonlea and Strongfield and significantly greater ($P < 0.05$) than Commander, AC Morse and AC Navigator in three years of testing (Table 3). Eurostar had yellow pigment concentration significantly greater than all the checks except Commander and AC Navigator, semolina yield in the range of the check cultivars and gluten index significantly greater than all checks except Commander (Table 3). Eurostar had low grain cadmium concentration similar to Strongfield (Clarke et al. 2005; data not shown), and no DNA fragment was amplified with the OPC-20 cadmium marker described by Penner

Table 2. Agronomic characteristics (least square means) of Eurostar and check cultivars in the Durum Cooperative Test, 2005 to 2007

	Days to maturity			Test weight			1000-kernelwt. (g)	Height (cm)	Lodging (1–9) ^y
	Zone 1 ^z	Zone 2	Mean	Zone 1	Zone 2	Mean			
	(kg hL ⁻¹)								
AC Avonlea	96	104	101	75.6	78.9	77.9	40.4	94	3.2
AC Morse	96	104	101	74.2	78.2	77.0	39.7	89	2.4
AC Navigator	98	106	103	75.5	80.0	78.5	41.1	79	2.5
Strongfield	97	104	102	76.8	79.8	78.8	40.3	92	3.1
Commander	97	105	102	74.6	79.1	77.6	41.6	76	2.0
Eurostar	99	106	104	77.5	80.5	79.6	40.9	96	3.6
LSD _{0.05}	2	1	1	1.3	0.6	0.8	1.5	2	0.8
No. tests	10	17	27	13	22	35	35	35	12

^zZone 1 (Black Soils): Indian Head, Souris, Glenlea (2005 abandoned, 2007 not seeded), Brandon, Langdon.

Zone 2 (Brown and Dark Brown Soils): Swift Current, Stewart Valley, Saskatoon, Regina, Lethbridge, Irricana (2005), Bieseker (2006 and 2007), Shouldice (2005), Vanguard (2007), Avonlea (2006 and 2007).

^y1 = no lodging, 9 = completely lodged.

Table 3. Grain protein concentration (expressed on 13.5% moisture basis) measured on location composites of replicates; pigment concentration, semolina yield and gluten index measured on composites of locations within years of Eurostar and checks from the 2005 to 2007 Durum Cooperative tests

	Protein concentration						Mean	Pigment	Semolina	Gluten
	2005		2006		2007					
	Zone1 ²	Zone 2	Zone 1	Zone 2	Zone 1	Zone 2				
	(g kg ⁻¹)							(mg kg ⁻¹)	yield (%)	index (%)
AC Avonlea	155	144	151	143	158	142	144	8.36	65.7	35
AC Morse	147	139	145	142	152	135	139	8.47	65.3	59
AC Navigator	142	137	142	134	148	138	137	9.67	66.8	77
Strongfield	160	143	149	142	160	142	144	8.81	65.3	75
Commander	146	138	143	137	147	137	138	9.93	66.7	95
Eurostar	152	142	155	139	165	144	144	9.22	65.9	92
LSD _{.05}	7	6	8	5	6	4	3	0.36	0.8	5
No. tests	3	7	4	7	3	8	32	3	3	3

²Zone 1 (Black Soils): Indian Head, Souris, Glenlea (2005 abandoned, 2007 not seeded), Brandon.

Zone 2 (Brown and Dark Brown Soils): Swift Current, Stewart Valley, Saskatoon, Regina, Lethbridge, Irricana (2005), Bieseker (2006 and 2007), Shouldice (2005), Vanguard (2007), Avonlea (2006 and 2007).

et al. (1995), indicating that it has the low cadmium allele described by Clarke et al. (1997). Eurostar was resistant to races of leaf and stem rust and common bunt found in the prairie region of Canada (Table 4). Eurostar was susceptible to loose smut and comparable to the checks for leaf spot reaction. Eurostar showed a slight improvement in resistance to FHB compared to the other cultivars in the class, with an intermediate reaction in 2 of 3 yr in the Carman nursery and in 1 of 2 yr in the Glenlea nursery.

Other Characteristics

SPIKES. Tapering, mid-dense, long, erect, white awns; glumes wide, long, glabrous, white; glume shoulders straight to elevated, some slightly sloping; glume beak straight to slightly curved.

KERNEL. Colour amber; mid-size to large, elliptical; cheeks angular; crease mid-deep, mid-wide; brush small, short; embryo large, oval.

END-USE SUITABILITY. Eligible for the Canada Western Amber Durum wheat market class.

Table 4. Summary of disease reactions of Eurostar and check cultivars grown in the DurumCooperative Test, 2005 to 2007

Cultivar		Stem	Leaf	Common	Loose		Leaf	FHB Index and Reaction Type			
		rust	rust	bunt	smut		spots	Carman		Glenlea	
AC Avonlea	2005	R ^z	R ^z	MR-I ^z	73.0 ^x	S ^z	7.3 ^y	31.3 ^w	MS ^z	–	–
	2006	R	R	VR	0.0	R	7.0	45.7	S	67.5 ^v	S ^z
	2007	VR	R	VR	83.3	S	8.8	39.3	MS	43.0	S
AC Morse	2005	R	R	R	60.0	MS	7.0	51.2	S	–	–
	2006	R	R	VR	45.0	I	8.0	30.0	I	68.3	S
	2007	VR	R	VR	89.7	S	8.3	37.8	MS	42.5	S
AC Navigator	2005	R	R	R	–	–	7.2	29.3	MS	–	–
	2006	R	R	VR	48.0	I	8.0	29.5	I	63.0	S
	2007	VR	R	VR	50.0	I	8.5	36.6	MS	54.4	S
Strongfield	2005	R	R	R	38.7	I	6.7	24.8	MS	–	–
	2006	R	R	VR	–	–	7.5	39.8	MS	47.3	MS
	2007	VR	R	VR	20.5	MR	7.5	48.6	S	60.1	S
Commander	2005	R	R	R	63.6	MS	6.0	34.1	MS	–	–
	2006	R	R	VR	0.0	R	7.0	33.5	MS	42.0	S
	2007	VR	R	VR	100.0	S	8.5	43.7	MS	63.8	S
Eurostar	2005	R	R	R	44.4	I	7.0	33.2	MS	–	–
	2006	R	R	VR	83.3	S	7.5	22.8	I	35.0	I
	2007	VR	R	VR	–	–	8.3	24.8	I	51.7	S

^zReaction type: VR, very resistant; R, resistant; MR, moderately resistant; I, intermediate; MS, moderately susceptible; S, susceptible.

^yAdult plant, rated mid-grainfill at Swift Current (2005 and 2006) and Saskatoon (2007) a scale 0 = no symptoms, 11 = severe symptoms (McFadden 1991).

^x% incidence.

^wFusarium head blight index based on three replications: (% infected spikelets × % infected heads)/100; LSD_{0.05}: 8.0 (2005), 10.2 (2006), 14.7 (2007).

^vFusarium head blight index based on 2 replications (1 for Commander); LSD_{0.05}: 31.4 (2006), 35.9 (2007).

Maintenance and Distribution of Pedigreed Seed

Breeder seed will be maintained by the Seed Increase Unit, Agriculture and Agri-Food Canada, Indian Head, Saskatchewan, Canada S0G 2K0. Distribution and multiplication of pedigreed seed stocks will be handled by SeCan, 501-300 March Road, Kanata, Ontario, Canada K2K 2E2.

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